

## CLAIMS

1           1. A cut off method for a cut off apparatus  
2 including:

3           -a preceding knife cylinder on whose peripheral  
4   surface a preceding helical knife is provided;

5 a following knife cylinder on whose peripheral  
6 surface a following helical knife, which cuts off band-like  
7 paper in cooperation with the preceding knife, is provided;

8 a preceding knife driving motor which rotationally  
9 drives the preceding knife cylinder;

10 a following knife driving motor which rotationally  
11 drives the following knife cylinder; and  
12 a cut off control device which individually controls  
13 the preceding knife driving motor and the following knife  
14 driving motor,

15 wherein said method comprises:

16 giving, when the band-like paper is cut, the preceding  
17 knife and the following knife a specified amount of torque  
18 in the direction in which the preceding knife and the  
19 following knife are pressed against each other, by means  
20 of the preceding knife driving motor and the following  
21 knife driving motor.

1           2. A cut off method as set forth in claim 1, wherein  
2 the value of the torque given by means of the preceding  
3 knife driving motor is the same as the value of the torque

4 given by means of the following knife driving motor.

1       3. A cut off control device for band-like paper,  
2 which device controls a preceding knife driving motor for  
3 rotationally driving a preceding knife cylinder on whose  
4 peripheral surface a preceding helical knife is provided  
5 and also a following knife driving motor for rotationally  
6 driving a following knife cylinder on whose peripheral  
7 surface a following helical knife is provided, said control  
8 device comprising:

9       a speed pattern generator, to which a paper feeding  
10 speed of the band-like paper and the sheet length to be  
11 cut off is input, for generating rotational speed patterns  
12 of the preceding knife driving motor and the following  
13 knife driving motor based on the input paper feeding speed  
14 and the input sheet length to be cut off and for outputting  
15 a speed instruction value;

16       a comparator which compares the speed instruction  
17 value from said speed pattern generator with a detected  
18 speed of the preceding knife driving motor or the following  
19 knife driving motor;

20       an instruction torque computing unit which computes  
21 rotational torque instruction values for the preceding  
22 knife driving motor and the following knife driving motor  
23 based on a signal from said comparator;

24       a cutting torque computing unit which computes  
25 cutting torque of the preceding knife driving motor and

26 the following knife driving motor;  
27 a to-be-given torque pattern generator which  
28 distributes the cutting torque sent from said cutting  
29 torque computing unit, and generates a to-be-given torque  
30 pattern based on the paper feeding speed of the band-like  
31 paper and the sheet length to be cut off, and outputs a  
32 to-be-given torque instruction value;  
33 an instruction torque subtractor unit which  
34 subtracts the to-be-given torque instruction value, output  
35 from said to-be-given torque pattern generator, from the  
36 rotational torque instruction value computed by said  
37 instruction torque computing unit;  
38 a preceding power amplifier which controls the  
39 preceding knife driving motor based on a computation result  
40 obtained by said instruction torque subtractor;  
41 an instruction torque adder which adds the rotational  
42 torque instruction value, computed by said instruction  
43 torque computing unit, to the to-be-given torque  
44 instruction value computed by said to-be-given torque  
45 pattern generator; and  
46 a following power amplifier which controls the  
47 following knife driving motor based on a computation result  
48 obtained by said instruction torque adder.

1 4. A cut off control device as set forth in claim  
2 3, wherein said cutting torque computed by said cutting  
3 torque computing unit has a cutting torque value necessary

4 for cutting off the band-like paper, said cutting torque  
5 value being based on the basis weight and the paper feeding  
6 speed input.

1 5. A cut-off control device as set forth in claim  
2 3 or claim 4, wherein said cutting torque computed by said  
3 cutting torque computing unit is large enough to resist  
4 a cut-off reactive force added from the band-like paper  
5 to the preceding and following knives, and also to give  
6 an appropriate contact force to the preceding and following  
7 knives.

1 6. A cut off control device as set forth in any  
2 one of claim 3 through claim 5, wherein said to-be-given  
3 torque pattern generated by said to-be-given torque  
4 pattern generator is a pattern having a rectangular shape,  
5 a trapezoidal shape, or a polygonal shape.

1 7. A cut off control device as set forth in any  
2 one of claim 3 through claim 6, wherein said to-be-given  
3 torque pattern generator changes the pattern of the  
4 to-be-given torque depending on the paper feeding speed.

1 8. A cut off control device as set forth in any  
2 one of claim 3 through claim 7, wherein said to-be-given  
3 torque pattern generator generates an identical  
4 to-be-given torque pattern for the preceding knife driving

5 motor and the following knife driving motor.

1           9. A cut off control device as set forth in any  
2 one of claim 3 through claim 8, said cut off control device  
3 being connected to a production management device  
4 including an input unit for inputting thereto the basis  
5 weight of the band-like paper and the sheet length to be  
6 cut off, which production management system (i) outputs  
7 the basis weight of the band-like paper to said cutting  
8 torque computing unit, and (ii) computes the rotation  
9 speeds of the preceding and following knife cylinders based  
10 on the basis weight of the band-like paper and the sheet  
11 length to be cut off, and (iii) outputs the resultantly  
12 obtained rotation speed to said speed pattern generator.

1           10. A cut off apparatus for cutting off band-like  
2 paper, comprising:

3           a preceding knife cylinder on whose peripheral  
4 surface a preceding helical knife is provided;  
5           a following knife cylinder on whose peripheral  
6 surface a following helical knife, which cuts off band-like  
7 paper in cooperation with the preceding knife, is provided;  
8           a preceding gear attached at one of the opposite  
9 ends of the rotation axis of the preceding knife cylinder;  
10          a following gear attached at one of the opposite  
11 ends of the rotation axis of the following knife cylinder;  
12          a preceding drive gear which has a meshing engagement

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13 with said preceding gear;  
14        a following drive gear which has a meshing engagement  
15 with said following gear;  
16        a preceding knife driving motor which rotationally  
17 drives said preceding drive gear;  
18        a following knife driving motor which rotationally  
19 drives said following drive gear, said following knife  
20 driving motor having the same rated capacity as that of  
21 said preceding knife driving motor; and  
22        a cut off control device which individually controls  
23 said preceding knife driving motor and said following drive  
24 gear.

1        11.    A cut off apparatus as set forth in claim 10,  
2 wherein at least either one of said preceding gear and  
3 said following gear has one or more teeth shaped so that  
4 said preceding gear and said following gear do not come  
5 into contact with each other, said one or more teeth being  
6 provided at a portion of said gear relating to a cut off  
7 operation performed by said preceding and following knives  
8 in cooperation with each other.

1        12.    A cut off apparatus as set forth in claim 10,  
2 wherein a part of at least either one of said preceding  
3 gear and said following gear has no teeth so that said  
4 preceding gear and said following gear do not come into  
5 contact with each other, said part with no teeth being

6 provided at a portion of said gear relating to a cut off  
7 operation performed by said preceding and following knives  
8 in cooperation with each other.

1 13. A cut off apparatus as set forth in claim 10,  
2 wherein at least either one of said preceding gear and  
3 said following gear has one or more teeth shaped so that  
4 said preceding gear and said following gear do not come  
5 into contact with each other after passing a specified  
6 distance from initiation of a cut off operation, said one  
7 or more teeth being provided at a portion of said gear  
8 relating to the cut off operation performed by said  
9 preceding and following knives in cooperation with each  
10 other.

1 14. A cut off apparatus as set forth in claim 10,  
2 wherein a part of at least either one of said preceding  
3 gear and said following gear has no teeth so that said  
4 preceding gear and said following gear do not come into  
5 contact with each other after passing a specified distance  
6 from initiation of a cut off operation, said part without  
7 teeth being provided at a portion of said gear relating  
8 to the cut off operation performed by said preceding and  
9 following knives in cooperation with each other.

1 15. A cut off apparatus as set forth in any one  
2 of claim 10 through claim 14, wherein the preceding and

3 following knife cylinders are cylindrical members made  
4 of carbon fiber reinforced plastic.

1 16. A cut off apparatus as set forth in any one  
2 of claim 10 through claim 15, comprising the cut off control  
3 apparatus as set forth in any one of claim 3 through claim  
4 9.

1 17. A cut off apparatus for cutting off band-like  
2 paper, comprising:

3 a preceding knife cylinder on whose peripheral  
4 surface a preceding helical knife is provided;

5 a following knife cylinder on whose peripheral  
6 surface a following helical knife, which cuts off band-like  
7 paper in cooperation with the preceding knife, is provided;

8 a preceding gear attached at one of the opposite  
9 ends of the rotation axis of the preceding knife cylinder;

10 a following gear attached at one of the opposite  
11 ends of the rotation axis of the following knife cylinder;

12 a preceding drive gear which has a meshing engagement  
13 with said preceding gear;

14 a following drive gear which has a meshing engagement  
15 with said following gear;

16 a preceding knife driving motor which rotationally  
17 drives said preceding drive gear;

18 a following knife driving motor which rotationally  
19 drives said following drive gear; and

20           a cut off control device which individually controls  
21    said preceding knife driving motor and said following knife  
22    driving motor,

23           wherein at least either one of said preceding gear  
24    and said following gear has one or more teeth shaped so  
25    that said preceding gear and said following gear do not  
26    come into contact with each other after passing a specified  
27    distance from initiation of a cut off operation, said one  
28    or more teeth being provided at a portion of said gear  
29    relating to the cut off operation performed by said  
30    preceding and following knives in cooperation with each  
31    other.

1           18.    A cut off apparatus for cutting off band-like  
2    paper, comprising:

3           a preceding knife cylinder on whose peripheral  
4    surface a preceding helical knife is provided;

5           a following knife cylinder on whose peripheral  
6    surface a following helical knife, which cuts off band-like  
7    paper in cooperation with the preceding knife, is provided;

8           a preceding gear attached at one of the opposite  
9    ends of the rotation axis of the preceding knife cylinder;

10          a following gear attached at one of the opposite  
11    ends of the rotation axis of the following knife cylinder;

12          a preceding drive gear which has a meshing engagement  
13    with said preceding gear;

14          a following drive gear which has a meshing engagement

15 with said following gear;  
16       a preceding knife driving motor which rotationally  
17 drives said preceding drive gear;  
18       a following knife driving motor which rotationally  
19 drives said following drive gear; and  
20       a cut off control device which individually controls  
21 said preceding knife driving motor and said following knife  
22 driving motor,  
23       wherein a part of at least either one of said preceding  
24 gear and said following gear has no teeth so that said  
25 preceding gear and said following gear do not come into  
26 contact with each other after passing a specified distance  
27 from initiation of a cut off operation, said part without  
28 teeth being provided at a portion of said gear relating  
29 to the cut off operation performed by said preceding and  
30 following knives in cooperation with each other.